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# PATENT SPECIFICATION

961,677

DRAWINGS ATTACHED.

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961,677



Date of filing Complete Specification : Sept. 27, 1961.

Application Date : Nov. 29, 1960. No. 40907/60.

Complete Specification Published : June 24, 1964.

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Index at Acceptance :—B8 H(2, 4, 15).

International Classification :—B 66 f.

## COMPLETE SPECIFICATION

### Surgical Patient-Lifting Trolley.

We, RUSTON & HORNSBY LIMITED, a Company registered under the laws of Great Britain, of Sheaf Ironworks, Waterside South, in the City and County of Lincoln, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement :—

This invention relates to a trolley for lifting, lowering, and transporting bed-patients, primarily intended for hospital use to facilitate the task of lifting a patient from a ward bed, transporting him to and from the operating table and returning him to bed. The invention mechanises these tasks, relieving almost all of the physical effort involved, and makes it possible for one operator, who may be unskilled, to carry them out. The invention also provides means for lifting, lowering, and transporting the patient in either a horizontal plane or a plane inclined about a transverse axis, with means for altering the angle of inclination at will, which facility is frequently desirable after the patient has undergone an operation.

The invention consists in a hospital bed-patient lifting and transporting trolley of side-pillar construction of the type wherein two stretcher-carrying cantilever arms are supported by two pillars mounted on one side of a wheeled base frame, and having power-assisted manual and pedal means for lifting and lowering said arms, thus lifting and lowering a bed-patient on a stretcher carried by said arms in either a horizontal plane or a plane inclined about a transverse axis, including means for altering the angle of inclination at any stage of the operations of lifting, lowering, or transportation, and maintaining the

desired angle of inclination throughout any of the said operations.

In the preferred embodiment of the invention, the said side-pillar construction consists in a low four-wheeled base frame forming substantially one longitudinal side and two lateral sides of a rectangle in plan, the longitudinal member extending beyond the lateral members by an equal amount at both ends, and the length of the wheel base being shorter than the longitudinal member by the total said amount; the said lateral members being spaced and dimensioned to enter below the bedstead and between the head and foot of a standard hospital bed when approaching the bed from one side, and also to pass either side of the central pedestal of an operating table: the said construction also consisting in two pillars extending vertically from opposite ends of said longitudinal member, each pillar slidably housing a portion of a stretcher-carrying cantilever arm extending laterally and horizontally therefrom, the said arm being pivoted to allow ninety degrees movement from the horizontal in a vertical plane, and the upper edges of each said arm having two spaced projections thereon to hold the ends of stretcher poles.

Preferably the said power-assisted lifting means include two separate hydraulic pumps, each pump being plunger-operated by foot pressure on a pedal, and the two pedals being located side by side to facilitate operation of either pedal separately or both pedals simultaneously by the pressure of a single foot; each pump effecting raising of a said cantilever arm through a non-return valve and a piston located in each said vertical pillar, said piston being axially responsive to

[Price 4s. 6d.]

hydraulic pressure: and the said power-assisted lowering means include a normal lowering system in which each pedal, on being lifted by foot above its normal pumping arc, opens a small vent hole, allowing pressurised fluid to leak to a reservoir and the associated arm to descend; and an emergency lowering system in which operation of a hand lever actuating a wire cable and sheath associated with each pump effects quicker relief of pressure by opening a larger vent hole.

In the preferred embodiment of the invention one of the said two projections on the upper edge of each cantilever arm is fixed and the other is movable with respect to its arm in a direction away from the fixed projection, the movement being effected against spring loading on initial upward movement of said piston by means of a linkage between said piston, the portion of said arm slidably housed within said pillar, and said movable projection.

Preferably, the said stretcher consists in a stretcher canvas sewn into tubular form, and two removable poles constructed of square section light metal tubing flanged at the extremities.

The following is a description of an embodiment of the invention, with reference to the accompanying drawings in which:—

Figure 1 is an isometric view of the trolley; and

Figure 2 is a view of part of the trolley in the direction of arrow A, Figure 1.

The trolley frame of side-pillar construction includes one or more, but preferably only one low horizontal frame member 11 of hollow rectangular or square section, forming one longitudinal side of a rectangle when seen in plan, attached to which are two swivelling caster wheels 12, 13, the said longitudinal member 11 extending beyond wheels 12, 13: two low base frame members 14, 15, rigidly attached to member 11 and laterally extending therefrom, forming substantially two lateral sides of a rectangle, and each bearing at its extremity a further swivelling caster wheel 16, 17. The member 11 extends beyond lateral members 14, 15, by an equal amount at both ends, and the length of the wheel base is shorter than member 11 by the total said amount. Members 14, 15, with wheels 16, 17, are spaced and dimensioned to enter below the bedstead and between the head and foot of a standard hospital bed when approaching the bed from one side, and also to pass either side of the central pedestal of an operating table, and low enough to avoid obstruction of levers and the like under the operating table. It is not considered necessary that members 14, 15, should be sufficiently long to correspond with the width of a bed, and wheel track width can be accordingly narrower than that of a

bed. The caster wheels are antistatically tyred and may be equipped with steering locking means. The upper part of the construction includes two hollow rectangular or square section pillars 18, 19, extending vertically and rigidly from opposite ends of the longitudinal base frame member 11, each pillar slidably housing a portion of a stretcher-carrying cantilever arm 20, 21, extending laterally and horizontally therefrom. The upper edges of each arm 20, 21, have two spaced projections 22A, B, C, and D (of which 22D is not visible in the drawings) to hold the ends of two stretcher poles. Arms 20, 21 are parallel to each other, the distance between said arms and the distance between said projections being such as to conveniently receive, preferably, a special stretcher (not shown) the canvas of which is preferably sewn into tubular form, the removable poles of which are made of square section light metal tubing flanged at the extremities to prevent the poles sliding from their position when the stretcher is on an inclined plane. The said flanges are preferably formed with rounded, coned, or chamfered ends to facilitate their entry into the stretcher canvas. The trolley may be wheeled by hand pressure one one of the cantilever arms, or a folding handle may be fitted to one of the frame members.

The power-assisted manual and pedal means for lifting and lowering and inclining the plane of the stretcher includes two separate mechanical-hydraulic pumps operated by foot pressure on pedals 23, 24, one pedal operating each pump. The said pedals may be foot-operated independently or both together by a single foot of one operator, so that a stretcher carried by cantilever arms 20, 21, may be raised or lowered in a horizontal plane, but in the case of, for example, a patient whose body must be placed in and remain on a plane inclined about a transverse axis, either cantilever arm may be raised or lowered independently of the other. The two separate hydraulic pumps (said pumps and associated internal parts not shown) are housed in one casing 25 which may be part of the base frame, at a convenient position near the floor, and are fed from a common reservoir of working fluid. Foot pedals 23, 24, are pivoted from a shaft inside the casing 25 and are cranked to clear the base framework, each pedal protruding clear of the framework for easy access, and horizontally aligned, approaching each other with a clearance of, for example, half an inch, to facilitate foot operation of either pedal separately and to allow operation of both pedals simultaneously.

The following is a description of one of the mechanical-hydraulic pumps and its action. Pressure on foot pedal 24 causes a limited angular movement of the pedal round a shaft

to which it is pivoted, and causes a lever, to which the pedal is secured against relative movement, to descend upon the head of a pump plunger against the pressure of a return spring. The descending plunger pumps working fluid through a non-return valve to a pipe which may be flexible and which may be concealed in one or more of the base frame members. The said pipe leads through a seal to a piston situated within pillar 19, said piston being axially responsive to hydraulic pressure, and raising cantilever arm 21 by pressure against a portion 26 of the arm 21 slidably housed within pillar 19. Load on arm 21 is spread through part of pillar 19 and friction is reduced by a plurality of ball-bearing rollers rotatably attached to portion 26 of arm 21 housed within pillar 19. A vertical slot 27 (Figure 2) is formed in pillar 19 to allow raising and lowering of arm 21. The piston has a large length-to-diameter ratio to facilitate raising of arm 21 without exposing the foot of the piston to the bottom of slot 27. Portion 26 of arm 21 may be integral with arm 21 or may be constructed of a plurality of parts suitably secured thereto. Part of arm 21 may be pivoted in a vertical plane at a joint conveniently situated where portion 26 is secured to arm 21, the pivoting action being limited to ninety degrees movement, from horizontal to vertical and back again, a positive stop preventing arm movement below the horizontal. The said movement allows the trolley to approach the side of a bed with the arms in a vertical position, and allows pillows, blankets, and the like to be removed before the arms are placed in a horizontal position at the head and foot of the patient prior to lifting. A stretcher-tautening action may be provided, to act before lifting begins, by the following means: of the projections on arm 21, 22A is fixed, but 22B (Figure 2) is capable of limited movement with respect to its arm in a direction away from fixed projection 22A, that is, toward pillar 19. The said limited movement may be made against spring loading which holds movable projection 22B at such a distance from fixed projection 22A that a loaded stretcher, with its tendency for the parallel poles to close in toward each other, may be easily placed on the trolley. On foot pressure being applied to pedal 24, the initial upward movement of the said piston is arranged to act through portion 26 of arm 21 on a linkage which moves projection 22B away from fixed projection 22A against the force of said spring loading, effecting the desired state of lateral tautness to the stretcher canvas. Continuation of the piston movement then acts through portion 26 to lift arm 21 as described. A fail-safe means may be provided, consisting of a relief valve fitted in the pressurised system between the non-return valve and the piston. The relief valve is adjustable, and is set to open a small vent hole and allow working fluid to leak back into the reservoir if the weight loaded is above the safe working load of the mechanism, and also when arm 21 reaches its maximum height, at which a stop is fixed, to prevent overpressurisation. A normal lowering system is provided in which the said small vent hole may be opened by lifting pedal 24 by foot. The said relief valve is linked by a rod to the pumping lever in such a way that while pump pedal 24 moves through its normal pumping arc, the relief valve is not affected, but on lifting pedal 24 by foot above its normal arc, the rod opens the said small vent hole and the arm descends slowly under its load, the speed of descent substantially depending upon the size of said small vent hole. An alternative emergency lowering system may be provided in addition to the said normal lowering system, in which a wire cable and sheath 28 of the Bowden type are operated by hand lever 29 attached at a convenient position near the top of, and at the inner side of pillar 19, the cable 28 leading therefrom, preferably concealed for at least part of its length in one or more of the frame members, to the relief valve. Operation of hand lever 29 effects quicker relief of pressure in the working fluid pipe by allowing fluid to leak through a larger vent hole back to the reservoir, and hence allowing the piston and cantilever arm 21 to descend more speedily under their load.

The foregoing description of one power-assisted manual and pedal system for lifting and lowering one cantilever arm applies equally to the other separate system. All the movements described for one arm may therefore be controlled to occur independently of the movements of the other arm, or both arm movements may be controlled to occur simultaneously.

In use, for instance, in moving a bed-patient to and from a hospital operating theatre, the patient will, in the normal practice, be placed on a stretcher canvas in bed. It is not considered necessary to lift the patient from the longitudinal centre of the bed, but rather from the side of the bed to which access may be most freely gained by the trolley, which will be wheeled alongside the bed, and lateral base frame members 14, 15, will pass under the bedstead, clearing the bed legs by reason of the members 14, 15, making a wheel base shorter than the overall length of a standard bed. Cantilever arms 20, 21, may be in the vertical position whilst the trolley is not loaded, but will be manually adjusted to lie horizontally over the bed when the patient is ready for lifting. The arms will then be adjusted by pedal operation to such a height that the stretcher poles may be inserted into the stretcher canvas and rest against the arm projections whilst the patient

is still lying on the bed. After initial pedal pressure has laterally tautened the stretcher, and assuming that the patient may remain in a horizontal plane, both hydraulic systems are operated simultaneously by foot pressure from one of the operator's feet, and the patient is raised clear of the bed and wheeled to the operating theatre. If the patient is required to be placed on a plane inclined about a transverse axis, either hydraulic system may be operated independently of the other to secure the desired angle of inclination within the capabilities of the trolley. The open-sided construction allows unobstructed access to the patient from either side and from head or foot whilst on the trolley. To transfer the patient to the operating table, the trolley is brought alongside and wheeled under so that the patient is directly over the table. The wheels will clear the operating table support, whether a central pedestal or four legs, again by reason of the disposition of the frame and wheels, and the patient is lowered either by foot or hand operation and the stretcher poles removed.

#### WHAT WE CLAIM IS:—

1. A hospital bed-patient lifting and transporting trolley of side-pillar construction of the type wherein two stretcher-carrying cantilever arms are supported by two pillars mounted on one side of a wheeled base frame, and having power-assisted manual and pedal means for lifting and lowering said arms, thus lifting and lowering a bed-patient on a stretcher carried by said arms in either a horizontal plane or a plane inclined about a transverse axis, including means for altering the angle of inclination at any stage of the operations of lifting, lowering, or transportation, and maintaining the desired angle of inclination throughout any of the said operations.

2. A trolley according to Claim 1 in which the said side-pillar construction consists in a low four-wheeled base frame forming substantially one longitudinal side and two lateral sides of a rectangle in plan, the longitudinal member extending beyond the lateral members by an equal amount at both ends, and the length of the wheel base being shorter than the longitudinal member by the total said amount; the said lateral members being spaced and dimensioned to enter below the bedstead and between the head and foot of a standard hospital bed when approaching the bed from one side, and also to pass either side of the central pedestal of an operating table: the said construction also consisting in two pillars extending vertically from opposite

ends of said longitudinal member, each pillar slidably housing a portion of a stretcher-carrying cantilever arm extending laterally and horizontally therefrom, the said arm being pivoted to allow ninety degrees movement from the horizontal in a vertical plane, and the upper edges of each said arm having two spaced projections thereon to hold the ends of stretcher poles.

3. A trolley according to Claims 1 and 2 in which the said power-assisted lifting means include two separate hydraulic pumps, each pump being plunger-operated by foot pressure on a pedal, and the two pedals being located side by side to facilitate operation of either pedal separately or both pedals simultaneously by the pressure of a single foot; each pump effecting raising of a said cantilever arm through a non-return valve and a piston located in each said vertical pillar, said piston being axially responsive to hydraulic pressure: and the said power-assisted lowering means include a normal lowering system in which each pedal, on being lifted by foot above its normal pumping arc, opens a small vent hole, allowing pressurised fluid to leak to a reservoir and the associated arm to descend; and an emergency lowering system in which operation of a hand lever actuating a wire cable and sheath associated with each pump effects quicker relief of pressure by opening a larger vent hole.

4. A trolley according to Claims 2 and 3 in which one of the said two projection on the upper edge of each cantilever arm is fixed and the other is movable with respect to its arm in a direction away from the fixed projection, the movement being effected against spring loading on initial upward movement of said piston by means of a linkage between said piston, the portion of said arm slidably housed within said pillar, and said movable projection.

5. A trolley according to any of the preceding claims in which a stretcher carried on said cantilever arms consists in a canvas sewn into tubular form, and two removable poles constructed of square section light metal tubing flanged at the extremities.

6. A hospital bed-patient lifting and transporting wheeled trolley of side-pillar construction substantially as described with reference to the drawings.

For and on behalf of  
RUSTON & HORNSBY LIMITED.

C. J. HIND,  
Engineering Director.

961677  
1 SHEET

COMPLETE SPECIFICATION

This drawing is a reproduction of  
the Original on a reduced scale

